

KEY

Practice problems for myoglobin and hemoglobin

1) Compare and contrast the main ideas of the concerted and sequential models of O₂ binding to hemoglobin.

- BOTH MODELS ADDRESS THE COOPERATIVITY OF THE 4 BINDING SITES IN Hb.
- THE CONCERTED (AKA "SYMMETRY" OR "MWC") MODEL ASSUMES THAT ALL SUBUNITS ACT SIMULTANEOUSLY - ALL HIGH AFFINITY (R-STATE) OR ALL LOW AFFINITY (T-STATE)
- THE SEQUENTIAL MODEL ASSUMES THAT ALL SUBUNITS CAN ACT INDEPENDENTLY. WHEN O₂ BINDS TO A SUBUNIT, IT CAN UNDERGO A T → R TRANSITION INDEP. OF THE OTHER 3 SUBUNITS. OTHER SUBUNITS ^{THEN} BECOME MORE LIKELY TO BIND O₂ AND UNDERGO A T → R TRANSITION.

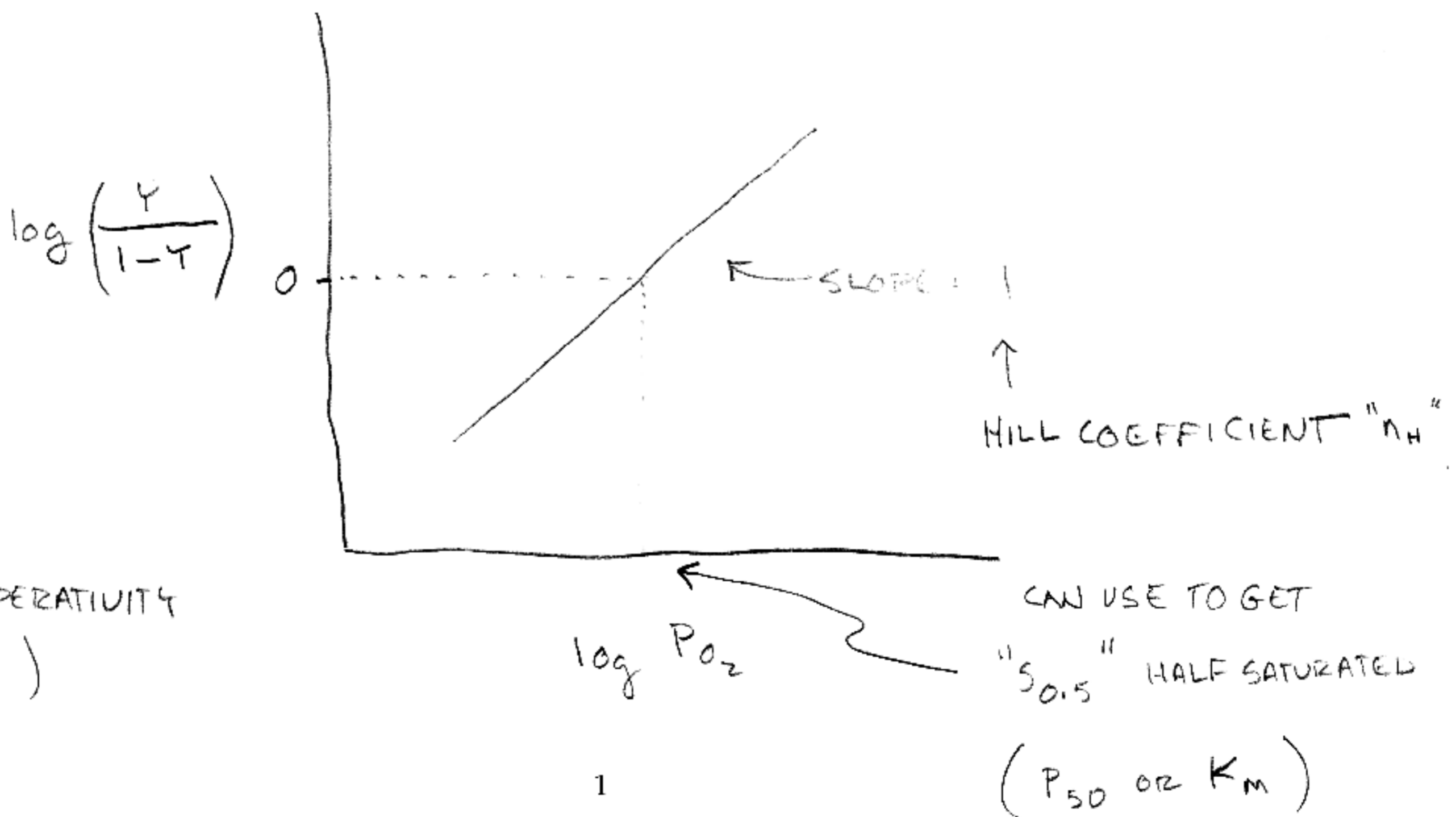
2) In your own words explain why the O₂ binding curve of hemoglobin looks different from the one observed for myoglobin (Fractional saturation vs pO₂).

MYOGLOBIN - NO COOPERATIVITY

HEMOGLOBIN - COOPERATIVE O₂ BINDING

3) Prepare a hypothetical scetch of a Hill plot for O₂ binding to myoglobin. Label both axes and indicate the slope(s) on the curve you draw. What is the Hill coefficient?

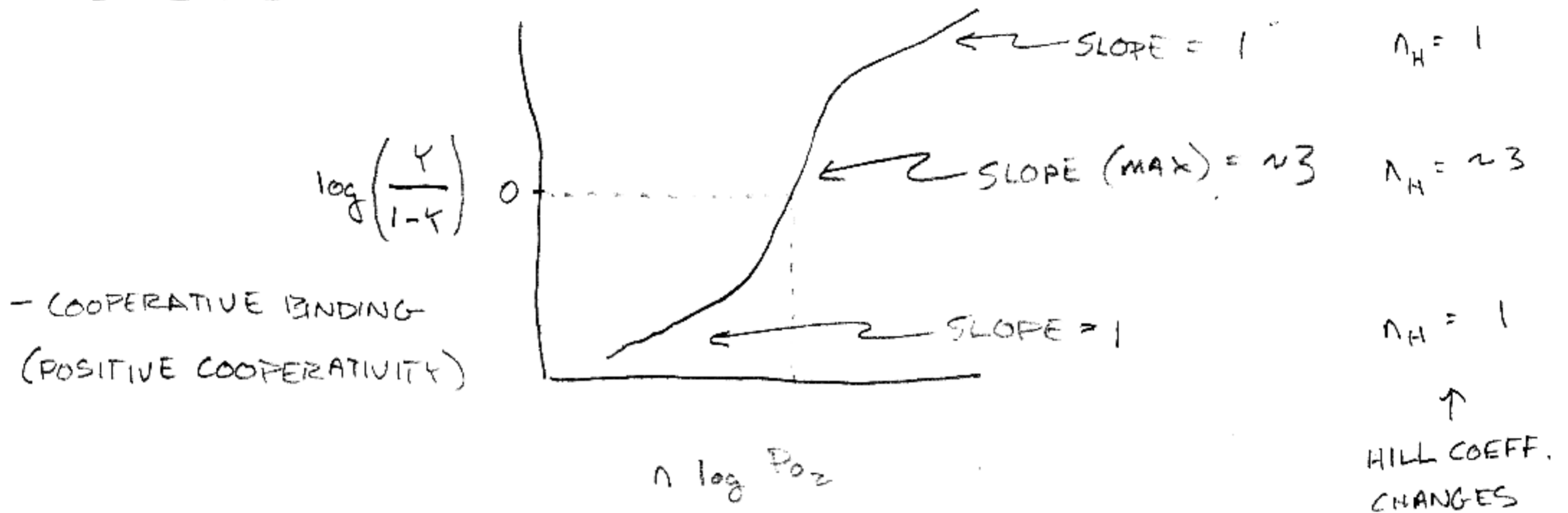
MYOGLOBIN:



-NO COOPERATIVITY
(n_H = 1)

4) Prepare a hypothetical sketch of a Hill plot for O₂ binding to hemoglobin. Label both axes and indicate the slope(s) on the curve you draw. What is the Hill coefficient?

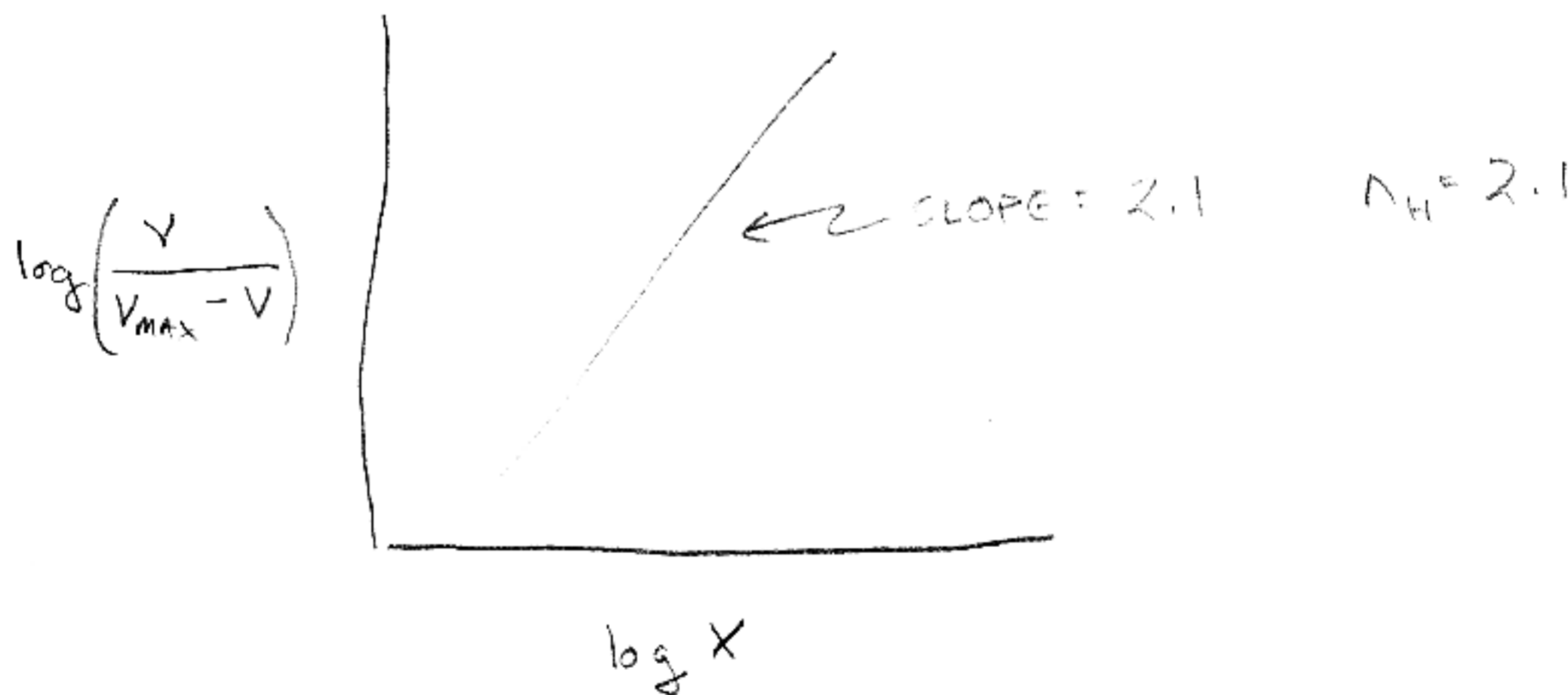
HEMOGLOBIN:



5) You are studying an enzyme has an allosteric activator molecule X. Using the same technique we used to derive the Hill equation for O₂ binding to hemoglobin, we can derive a similar expression for allosteric binding of an activator to an enzyme. A plot of this type yields a straight line with a slope of 2.1.

Sketch a Hill plot for this binding, label both axes and indicate the slope(s) on the curve you draw. What is the Hill coefficient?

ENZYME:



What can you say about the enzyme (be as specific as possible)?

- POSITIVE COOPERATIVITY - WHEN ONE MOLECULE OF "X" BINDS, THE NEXT "X" IS MORE LIKELY TO BIND
 - AT LEAST 2 BINDING SITES ($n_H = 2.1$), BUT PROBABLY MORE
- What can't you say about the enzyme (be as specific as possible)?

- THERE ARE 2 BINDING SITES FOR X
- THERE ARE 3 BINDING "2" "
- " 4 " "
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